A4 Total breakdown

Learn about:

- The digestive system
- Enzymes

Different sized particles

Each nutrient in our food is made up of particles. Carbohydrates, fats and proteins are all made of large particles. Vitamins and minerals are made of small ones. These particles are called molecules. You will learn more about **molecules** in Unit E Atoms and molecules.

Do you remember

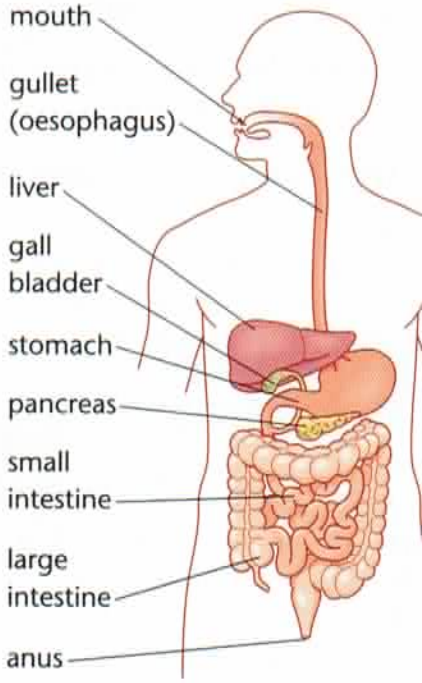
All matter is made of tiny particles we cannot see.

The long journey

When you chew up and swallow your food, it begins its journey through a long tube from the mouth to the anus. The tube is called the **gut** and it is nine metres long.

Food contains nutrients. Carbohydrates, fats and proteins are all large molecules. To get these nutrients into our bodies, these large molecules must be broken down into smaller molecules. This is a **chemical process** called **digestion**.

The **digestive system** includes all the organs that take part in digestion. They are shown in the diagram on the right.



The first part of the gut is called the **gullet** or **oesophagus**.

In the **stomach** the food is churned up for a while by its muscular walls. After a few hours the food has become a runny liquid. This leaves the stomach and enters a long tube called the **small intestine**.

As the food passes through the digestive system it is mixed with **digestive juices** that help to break down the different nutrients.

Breaking it down

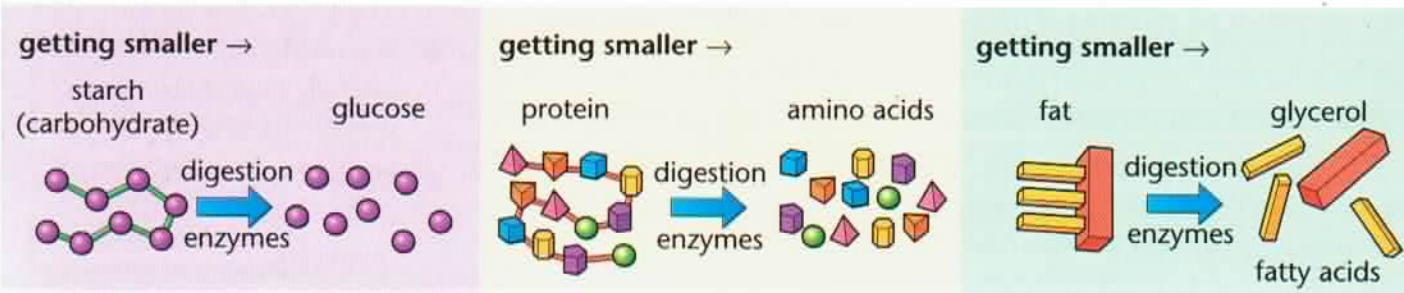
The digestive juices contain chemicals called **enzymes**. These help to break the larger molecules into smaller molecules. Enzymes make the digestion of food happen more quickly. Enzymes for digesting food are found in the mouth, stomach and small intestine.

Did you know?

Some washing powders are described as 'biological', and others are 'non-biological'. **Biological washing powders** contain enzymes that help to clean dirty clothes. They break down stains caused by proteins i foods such as egg or gravy.

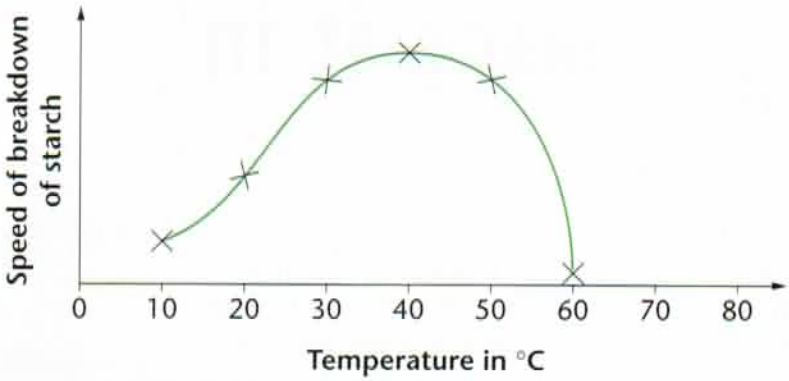
a **Why do you think it is important for food to be digested quickly?**

Each enzyme speeds up the breakdown of a different type of nutrient. Some break down carbohydrates, some break down proteins and others break down fats.



The right conditions

Each enzyme needs particular conditions to work. Saliva in the mouth contains an enzyme called **amylase** that helps to break down starch. Amylase works best at pH 7. It stops working in the stomach because the digestive juice there contains hydrochloric acid. Here the pH is low, which is best for the enzyme in the stomach that acts on proteins.



As well as pH conditions, enzymes also have particular temperatures at which they work best. Matt and Alison set up an experiment to find out the best temperature for amylase. The graph above shows their results.

(i) **At which temperature does the breakdown of starch take place in the shortest time?**
(ii) **Is there a relationship between how well amylase works and body temperature?**
(iii) **What do you think might have happened if the experiment had been carried out at 70 °C or 0 °C?**

Did you know?

If you leave bread out, fungi will start to grow in it and turn it mouldy. Fungi secrete enzymes onto the bread to digest it. Then they can take in the smaller molecules. The bread becomes very slimy.

Beaumont's experiment

In 1922 a particularly interesting experiment started to find out what happens in the stomach. An American army porter called Alexis St Martin was accidentally shot in the stomach. The hole never healed properly, but a flap of skin grew over it.

Dr William Beaumont sampled the stomach contents through this flap. He tied a piece of meat to the end of a silk string, dangled it through the hole into St Martin's stomach and pulled it out a couple of hours later to see if it had been digested.

In one of Beaumont's experiments, St Martin ate a meal of bread, beef, potatoes and turnips. Beaumont sampled the contents of his stomach over a period of three hours. He found that the meat was digested faster than the vegetables.

(i) **Which nutrient was digested most quickly in the stomach?**
(ii) **Which nutrient is meat mainly made out of?**
(iii) **What can you conclude about the digestive juice in the stomach from Beaumont's experiment?**

Questions

1. Design a poster to show what happens when food is broken down. Include the role of enzymes.
2. Milly says scurvy is caused by people not having an enzyme to digest vitamin C. Do you agree with her? Explain your answer.
3. Do you think Beaumont's experiment would be allowed today? Explain your answer.

For your notes:

- **Digestion** takes place in the **digestive system**.
- Digestion is the breakdown of large food **molecules** into small food molecules.
- **Enzymes** speed up the breakdown of food.
- Different enzymes work on different nutrients.